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Outcomes of teenage pregnancies in an outpatient environment in Germany: an observational study

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vorgelegt von

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1. INTRODUCTION

Pregnancies in children and adolescents remain a challenging situation. Adolescent pregnancy, also referred to as teenage pregnancy, is defined as pregnancy that occurs in women between the ages of 10 and 19 years. These pregnancies continue to be a multidimensional problem facing families and society.

The unique needs presented by adolescents during pregnancy and postpartum have prompted the development of models for antenatal and postpartum care specific to adolescents in order to enable them to achieve their full potential in life and improve maternal as well as child health.

1.1. INCIDENCE OF TEEN PREGNANCIES

1.1.1. WORLDWIDE

According to the World Health Organization (WHO), women between the ages of 15 and 19 years give birth to about 16 million newborns worldwide every year. Associated pregnancy and delivery complications are considered to be the second cause of death for 15- to 19-year-old girls. Their babies also face a substantially higher risk of dying than those born to women aged 20 to 24 (WHO 2014).

A constant decline of teenage pregnancies has been observed over the past decades, especially in the developed industrial nations. Countries with low levels of adolescent pregnancy, childbearing and sexually transmitted infections (STIs) are characterised by social acceptance of adolescent sexual relationships, combined with comprehensive and balanced information about sexuality and clear expectations about commitment, and prevention of pregnancy within these relationships (Darroch et al. 2001).

The increased use of contraception, the importance of education, motivation of young people to achieve higher levels of education and training, and a greater centrality of goals other than motherhood and family foundation for young women have been identified as factors reducing teenage pregnancies (Singh & Darroch 2000).

1.1.2. EUROPE

Even though in Europe the mortality of pregnant girls is low, teenage birth is a preoccupying situation as it is often associated with economic and social issues, such as alcohol and drug misuse and that women who gave birth as teenagers were twice as likely to be living in poverty compared to those who first gave birth when they were over 20 (UNICEF 2001).

In European countries the incidence of teenage pregnancies shows great variabilities. In 2011 the fertility rate was the highest in England and Wales with 47 pregnancies per 1,000 teenagers and lowest in Switzerland with 8 pregnancies per 1,000 teenagers. The proportion of teen pregnancies that ended in abortion varied widely across the countries, from 17% in Slovakia to 69% in Sweden, with half of the countries having a rate varying between 35% and 55%. The highest abortion rate among countries with complete abortion records was in England, Wales and Sweden with 20 abortions per 1,000 teenagers and lowest in Switzerland with 5 abortions per 1,000 teenagers (Sedgh, 2015).

1.1.3. GERMANY

There is no systematic and methodical uniform registration of pregnancies in Germany. Thus, pregnancy rates are calculated by adding birth and abortion statistics – excluding undisclosed miscarriages – therefore certainly leading to an underestimation of pregnancy rates.

The birth statistics are a full survey with mandatory reporting of documents filled out by the registrar (or by health care facilities). Information is collected on all live births and stillbirths recorded by the Federal Statistical Office of Germany, including date of birth, sex, body weight, body length of the child, marital status and age of parents, municipality of residence, religious affiliation and citizenship, employment of the mother, multiple births and sequence of births for all of the mother's children.

The statistics are based on a continuous complete enumeration. The quality of the secondary data for statistical purposes is considered to be very good.

Federal statistics on induced abortion in Germany are calculated every quarter pursuant to the Act on Assistance to Avoid and Cope with Conflicts in Pregnancy (Schwangerschaftskonfliktgesetz) of 27 July 1992, most recently amended on 8 December 2010. Paragraphs 15 to 18 of the Act stipulate that the data should be

collected at quarterly intervals directly from the Federal Statistical Office, specifying the information to be requested and those obliged to provide it. Owners of doctors' surgeries and managers of hospitals where abortions are carried out are obliged to provide statistics.

There are marked regional differences within Germany: birth rates and pregnancy rates are less frequent in the south of Germany whereas they are relatively high in the metropolitan areas of Berlin and Hamburg. This is probably due to the latter having a higher proportion of socially disadvantaged adolescents and a higher rate of unconventional sexual practices. These regional differences between rural and metropolitan areas have also been observed in other countries (Thoss et al. 2006).

In order to prevent teen pregnancies, much effort has been put into the analysis of predisposing factors and in developing prevention programmes. Great emphasis has been placed on sexual education and contraception to avoid teenage pregnancies and to enable teenagers to achieve their full potential in life and improve maternal and child health. As a result, birth rates as well as abortion rates for under 18 year olds have almost halved from approximately 14,000 pregnancies in 2004 to 7,400 in 2013. For 18- to 19-year-old women, numbers decreased from 27,400 to 17,200 (Diagram 1) (Federal Statistical Office 2013).

Even when taking into account an overall decline in the population, the number of births is decreasing: in 2004, about 5 births per 1,000 women aged 15 to 17 and 20 births per 1,000 women aged 18 and 19 were registered, while in 2012, there were only 3.5 and 14.5 births respectively per 1,000 women of each age group (Federal Statistical Office 2013).

The number of abortions for underage women decreased to half of the initial number in 2004. In 2013 the calculated quota for terminations for teenagers aged from 15 to under 18 years was 2.8 and for the 18 and 19 year olds, the number was 7.6 per 1,000 women of the age group. Until 2009 the probability for under 18-year-old teenagers was higher to opt for an abortion; this trend has changed even though the rate stays close to 50% (Federal Statistical Office 2013).

Les paramètres requis sont manquants ou erronés.

Diagram 1: Number of induced abortions and live births for the different age groups

Source: Federal Statistical Office 2013

1.2. Understanding adolescent pregnancy in Germany – what is known already?

In Germany, sexual relations between adolescents are common and widely socially accepted. Several surveys have previously been conducted with the express goals of revealing trends in educational levels, social disadvantages, family background, living circumstances, migration background, partnerships, sexual behaviour and attitudes, contraception and decision-taking on interrupting or not a pregnancy (Thoss et al. 2006).

In accordance to studies from other countries, multiple factors were reported that increase the likelihood of teenage pregnancy, often being linked one to another (Cox 2012, Thoss et al. 2006).

1.2.1. Teen sexuality

Even though influenced largely by their environment, intrapersonal aspects are an important risk factor for teenage pregnancy. Sexual attitudes, contraceptive behaviour, emotional well-being and problems, or risk-taking play an important role. The majority of young women in the developed world become sexually active during their teenage years.

For the last 30 years, the age of girls' menarche has decreased continuously: While in 1980 only 35% had their menarche at the age of 12 or earlier, in 2010 43% of the assessed girls had their menarche during that age interval (Hessling 2010). Over the same period of time, the age of first sexual intercourse for German teenagers decreased steadily until recently when the tendency slowed down and even started to reverse. Whether an earlier sexual maturity is associated with an earlier onset of sexual activities is a subject of controversial discussion (Marino et al. 2013, Hoier 2003).

Naturally, the probability of becoming pregnant is directly proportional to the frequency of unprotected sexual intercourse. The age of first sexual intercourse and its following frequency are therefore risk factors for teenage pregnancy. Likewise, the

likelihood that a teenager will have vaginal intercourse increases with age: The average age of first intercourse among German teens is 17 years for males and 17.4 years for females, varying slightly between racial and ethnic groups (Hessling 2010). In 2009, 7% of 14-year-old girls had experienced vaginal intercourse and 66% had vaginal intercourse before age 18. Girls with a migrant background are generally more reserved than girls with German citizenship and teenagers from dysfunctional families have a tendency to start sexual intercourse earlier (Kaestle et al. 2005, Thoss et al. 2006, Hessling 2010).

For the majority of young people, their first sexual intercourse is the start of a regular sex life. Most German adolescents first have intercourse in a steady romantic relationship and are older on average than those whose first time was not experienced with a steady partner. The younger the girls were at the time of first sexual intercourse the more likely they were to subsequently have many different partners, especially if they did not know their first sexual partner very well (Hessling 2010).

Teenage pregnancy is closely associated with insufficient and risky contraceptive behaviour. Contraceptive behaviour is a complex issue combining multiple interacting factors. Easy access to contraceptives and other reproductive health services contributes to better contraceptive use and low teen pregnancy rates (Darroch et al. 2001). In Germany, oral contraceptives are free of charge for teenagers. Despite this gratuity some adolescents do not use contraception because they are not motivated to prevent pregnancy; they either “want to become pregnant” or “do not care” if they become pregnant (Unger et al. 2000). Two out of three young pregnant women indicated to have used either oral contraceptives or condoms when they got pregnant. Assuming protection by these “safe” methods suggests an insufficient comprehension about the functioning of the contraceptives (Thoss et al. 2006). Teenagers from dysfunctional families often have a permissive sexual attitude and use contraception less consistently (Hessling 2010). The partner's age also plays a role: same-aged couples had better contraception behaviour than those where the man was more than five years older, which could partly be due to the fact that the idea of having children seemed less frightening and more realistic.

1.2.2. EDUCATIONAL FACTORS

Educational level has a major influence on the probability of becoming pregnant as a teenager.

Young people with higher academic achievements are, on average, the oldest when they enter a sexual relationship for the first time. In all age groups, girls with lower academic achievements or who are not as closely involved in schooling get pregnant more often (54%) than girls with average (35%) or higher academic achievements (11%) (Thoss et al. 2006).

Planning to attend college after high school is associated with a lower risk of teen pregnancy. Half of those who disengage from school are not in employment or training (Kirby 2007). The higher rate of teenage pregnancy in girls with lower academic achievements is partly a result of beginning sexual relations at an earlier age than girls with higher academic levels, leading to a seven to eight months longer coitus-active time before their 18th birthday (Thoss et al. 2006). Low educational achievement is an important risk factor, but might also be the repercussion of other risk factors cited below which leadi\ to a future without or with poor prospects.

1.2.3. SOCIO-CULTURAL FACTORS

Teenage pregnancies occur in all social classes but the literature reports a higher prevalence in lower social-economic classes (Keskinoglu et al. 2007). Across 13 nations in the European Union, women who gave birth as teenagers were twice as likely to be living in poverty compared to those who first gave birth when they were over 20 (UNICEF et al. 2015).

Growing up in poverty and in socially disadvantaged areas or families has been associated with early sexual intercourse and a higher-risk behaviour concerning sexuality. Combined with psychological stress that has been associated with low socio-economic status it can markedly increase the risk of early pregnancy: a high proportion of pregnant teenagers' parents are unemployed and living in chronic multigenerational poverty whereas teens in families with higher incomes are less likely to become pregnant or to bear children (Kirby 2007, Ng & Kaye 2012, Mollborn & Morningstar 2009).

The regional differences reported in many studies of teenage pregnancy within a country are most probably linked those social-cultural differences around metropolitan areas.

1.2.4. INTRAFAMILIAL FACTORS

Pregnant teenagers very often live in unconventional familial environments. The family situation thus seems to be important in teenage pregnancy. Whereas high-quality family interaction, connectedness and satisfaction with relationships with greater parental supervision and monitoring were observed as protective factors, family dysfunction and poor supervision were important risk factors: almost half of the girls' parents were separated or divorced. This is particularly frequent in the families of the girls with low academic levels. They rarely lived with both parents, and frequently in single-parent households. Some of them experienced troubling and chaotic situations leading to an incapacity to organise their (sexual) life well. Teenagers from unconventional family surroundings sought relationships outside their family at an earlier point and relatively often did not live in the same household as their parents. These teenagers began sexual intercourse significantly earlier and the majority were in a relationship, thus probably having more regular and frequent sexual intercourse than their peers (Thoss et al. 2006, Santelli et al. 2000, Kirby 2007).

Teenage pregnancy has been described as a self-perpetuating cycle where early childbirth in one generation increases the likelihood that the following generation will also be comprised of adolescent mothers (Ng & Kaye 2012). When teen parents have siblings, their sisters' risk of becoming pregnant also increases (Thoss et al. 2006, Kirby 2007).

Pregnant teens are more likely to have been exposed to dating violence and are more likely to experience sexual abuse than pregnant adults. Investigations in mother-child institutions reported that a lot of mothers seeking help had experienced alcoholism, drug consumption, neglect or sexual abuse. If teens have been maltreated and physically abused by their families, they are much more likely to have sex at an early age and to become pregnant (Kirby 2007, Silverman et al. 2004).

1.2.5. PREGNANCY DIAGNOSIS AND COUNSELLING

In any adolescent who has achieved menarche and presents with one or more missed periods pregnancy should be considered. Though rare, pregnancies have been seen in teens before the appearance of their first menstrual period. In adolescent health care, the denial of sexual activity is not reliable enough to exclude pregnancy.

Ninety-two per cent of the teenagers expecting a baby reported their pregnancy as unintended. Of those who decided to continue the pregnancy, 88% reported it to be unintended, 4% were planned and 4% “didn't care” (Thoss et al. 2006).

A diagnosis of pregnancy may initially be received by a teen with shock, ambivalence, fear, anxiety, happiness or a combination of emotions. The important decision of terminating or continuing a pregnancy needs to be taken under time pressure, and pressure from the social environment and a teen's perception of the implications of pregnancy frequently bears little resemblance to reality. Counselling is therefore crucial, with the aim of advising and supporting pregnant women of all ages in their decisions.

In order to reduce barriers to care, multiple initiatives are aimed at pregnant adolescents in Germany. The governmental Federal Centre for Health Education offers a website devoted solely to "Pregnancy under 20", where, among other things, contact details of numerous counselling centres in each neighbourhood are listed.

In Germany everyone seeking counselling on pregnancy and childbirth has a statutory right to obtain comprehensive and, if they so wish, anonymous counselling. The legal regulations of Section 219 of the German Criminal Code and Sections 5 and 6 of the Act on Assistance to Avoid and Cope with Conflicts in Pregnancy (Schwangerschaftskonfliktgesetz) establish what has to be included and fulfilled by counselling. Counselling topics include pregnancy and parenthood, pregnancy conflicts, relationships and sexuality, and medical and legal questions.

1.2.6. INDUCED ABORTION

As seen in Diagram 1 (number of induced abortions and live births for the different age groups), there is a difference in decision-taking when subdividing teenagers into underaged (<18 years of age) and teenagers of 18 and 19 years of age. As already stated above, most pregnancies of young adolescents are unwanted and thus

abortion rates are high. Additionally, for abortions performed on medical grounds or on grounds related to crime, pregnancies can be terminated according to the so-called counselling provision (Section 218a (1) of the penal code) without being subject to prosecution. They have to be performed not more than twelve weeks since conception and after having completed pre-abortion counselling. As teenagers have a tendency towards late detection of their pregnancies, the time pressure on them is even higher than on older pregnant women. Reasons for delay in seeking abortion services include irregular menses, failure to recognise pregnancy symptoms, ambivalence about pregnancy, low educational levels, and a lack of awareness and availability of clinic assistance.

Counselling is critical to determining how the adolescent incorporates the experience into her life. It is important to discuss the reasons for her decision and who in her family and social network would support her. Half of the youngest group will opt for an induced abortion whereas the other half will decide to keep the baby. This is different for the older teenage group, where only one-third will opt for a pregnancy interruption. Ninety-nine per cent of terminations in underage girls are conducted in compliance with legal counselling regulations (Laue 2007). Teenagers with higher educational levels and career goals would rather terminate their pregnancies, as those goals would be more difficult to attain with a child (Thoss et al. 2006).

Statistical data on abortions in Germany is considered to be high quality and accurate, as for every abortion it is mandatory for the medical institutions to report data on the legal condition, marital status, patient's age and number of born children, duration of the interrupted pregnancy, type of interruption and if the interruption has been performed in a hospital or in an outpatient environment.

1.2.7. TEENAGERS CONTINUING THEIR PREGNANCIES

In international comparisons, as stated above, adolescent birth rates in Germany are quite low, with 3.5 births per 1,000 women aged 15 to 17 and 14.5 per 1,000 women aged 18 and 19 in 2012 (Federal Statistical Office 2013).

Decision-taking is, among other reasons, influenced by socio-educational levels, the couples' age, mental conditions and the time the pregnancy is detected. Eight percent of the under-aged pregnant women detected their pregnancy only after the twelfth week of gestation and did not have the choice to opt for an induced abortion

referring to the law on abortion (Thoss et al. 2006). In previous studies, adolescents showed higher sociodemographic risk factors: Pregnant teenagers deciding to keep the child were more likely to be single, nulliparous and had not attained their age-appropriate level of education compared with adult women (Fleming et al. 2013, Kingston et al. 2012). Unemployment of the woman's parents significantly increased the tendency not to interrupt the pregnancy and a lack of different perspectives can encourage teenagers to start a family (Emans et al. 2012, Thoss et al. 2006).

1.2.8. ORGANISATION OF ANTENATAL CARE

The aim of antenatal care is to ensure a healthy baby and minimise maternal risk, including an early, accurate estimate of gestational age, an identification of patients at risk for complications, and to anticipate and prevent problems before they occur. Emotional, educational and clinical support to assist future parents in leading healthier lives should easily be available.

In recent studies the importance of antenatal care has been repeatedly demonstrated and a correlation between maternal age and adverse outcomes was observed in adolescent mothers with inadequate antenatal care (Vieira et al. 2012, Fleming et al. 2013).

Antenatal care in Germany is regulated by law and structured by directives and standard procedures in the legally binding maternity guidelines (Mutterschafts-Richtlinien). It comprises prevention or early detection of diseases or unfavourable circumstances with risks for mother and child. Medical history, clinical examination, tests using advanced technology and three sonographic examinations are part of the guidelines.

In order to provide standardised care, this nationwide programme stipulates the following minimal number of antenatal care visits: monthly visits up to 28 weeks of gestation; from 28 weeks up to 36 weeks, visits and tests twice a month; and then weekly visits until delivery.

The follow-up of pregnancies in Germany takes place in a gynaecological outpatient office with optional additional care by a midwife.

Maternity guidelines (Federal Joint Committee 2014):

The following exams should be done as soon as pregnancy is detected:

- chlamydia trachomatis infections
- blood pressure
- urine (proteins, sugar, sediments, bacteriological analysis if necessary)
- haemoglobin analysis

every 4 weeks

- weight
- blood pressure
- urine

from the 6th month onwards

haemoglobin analysis (if normal at entry exams)

- fundal height
- foetal position and heart rate

Additionally, two exams are indicated for each of the last two months of pregnancy:

Pregnant women who haven't been diagnosed with diabetes before pregnancy should be offered a screening on pregnancy diabetes.

An ultrasound screening in each trimester is recommended in order to determine the gestational age, somatic development of the foetus, search for abnormal foetal characteristics and the early detection of multiple pregnancies.

Adolescence is a distinct and unique physical and developmental stage in a woman's life. Consequently, the diagnosis and management of pregnancy during this time, before the age of 20, deserves acknowledgement of its distinctive inherent risks. Extra support is needed to try to prevent poor child health outcomes and poor

maternal emotional health and well-being that are associated with teenage pregnancies. Therefore the supervision of very young primigravida (<18 years old) is part of the follow-up of high-risk pregnancies in the International Statistical Classification of Diseases (ICD) and also of the German maternal guidelines.

There are number of initiatives that are in place to support young parents from conception to birth and until the child is one year old. Multidisciplinary services between midwife-led, intensive home visiting programmes for vulnerable first-time mothers are frequently organised on a local basis. The improved outcome of adolescent pregnancies is often attributed to the use of skilled antenatal, childbirth and postnatal care and social assistance among adolescents.

1.2.9. PREGNANCY COURSE IN TEENAGE PREGNANCIES

Adverse events complicating the antenatal period can emerge at any point of the pregnancy. Since teenage pregnancies present a major health issue around the world, research has been conducted on maternal and foetal outcomes, the reporting of which displays controversial and somewhat disparate results. Recurrently described risks include induced hypertension, preterm labour and delivery, cephalo-pelvic disproportion, operative vaginal delivery and caesarean delivery. Complications concerning foetal outcomes include stillbirths, premature births, low birth weight infants, higher number of perinatal deaths, and higher neonatal and infant mortality (Kingston et al. 2012, Jolly et al. 2000, Jeha et al. 2015, Gilbert et al. 2004, Keskinoglu et al. 2007).

Some studies suggest that the risk of a poor outcome is related to young reproductive age and the competition for nutrients between the still-growing adolescent mother and her foetus, independent of poor socio-economic status, smoking and inadequate antenatal care (Jolly et al. 2000, Shrim et al. 2011, Ganchimeg et al. 2014).

Recent literature has begun to dispute these beliefs, however, and has stated that being underage on its own accord does not necessarily increase the number of adverse events, but that unfavourable outcomes are primarily linked to other risk factors. Apart from adolescents' physical or psychological particularities, socio-economic factors seem to have an impact on the course of pregnancy and its outcome. Thus, Adler reported that lower income pregnant women receive less

antenatal care, experience higher levels of stress and are more likely to deliver premature babies.

Favourable pregnancy outcomes were often attributed to proper care and social assistance during pregnancy: Teenagers who attended antenatal care appointments more frequently were less prone to suffer from sexually transmitted diseases or infections, miscarriages, anaemia, pregnancy-related hypertension or preterm birth (PTB) and exhibited less behavioural and emotional difficulties. (Quinlivan et al. 2004, Leppälahti et al. 2013, Jeha et al. 2015, Geist et al. 2006, Fleming et al. 2013).

Being a younger age can be a protective factor, as the risk of maternal chronic medical conditions having consequences for pregnancy and maternal and foetal outcomes, like diabetes mellitus, organic dysfunctions or allergies, increases with age.

In Germany, the socio-economic status and educational background of pregnant adolescents is significantly lower than of their non-pregnant peers, with an accentuated difference among teenagers who continue their pregnancy (Federal Centre for Health Education 2016).

1.3. AIM OF THIS STUDY

As stated above, pregnant teenagers present multiple characteristics that differ from older pregnant women, not only related to the obvious age differences. Being of young maternal age may result in additional consequences and risks to the pregnancy, not only pertaining to the newborn, but also to the mother's health. How do these factors affect the pregnancy itself and will they result in higher rates of adverse events?

The main focus in previous studies on adolescent pregnancies has been their prevention as well as their intrapartum and neonatal outcome, with less of a focus on the courses of the pregnancies themselves. Studies which concentrated on the course of pregnancies mainly relied on retrospective analysis of hospital records of mothers who gave birth in the respective institutions. This led to methodological limitations such as small sample sizes, incomplete documentation and bias with regard to patient selection.

In Germany, antenatal care is offered in obstetric offices entirely covered by the country's obligatory health insurance, and is used by nearly the entire pregnant population (UNICEF 2004). There is no centralised governmental health database that collects information on patient data in Germany, leading to methodological limitations in research concerning antenatal care due to small sample sizes in individual obstetric offices. Yet, adverse events during antenatal visits are coded with the International Classification of Diseases-10 (ICD-10) coding system in the practice. This information can be evaluated using data from pharmaco-epidemiological databases such as the IMS® (Intercontinental Marketing Service) Disease Analyzer database.

Pharmaco-epidemiological databases are useful tools that allow research in specific subpopulations due to their size and duration of observation. The IMS Disease Analyzer database provides real-world evidence via anonymised disease and therapy pathways in gynaecological practices by including a nationwide representative sample of their anonymised regular patient care data.

The aim of this study is to evaluate the course of pregnancy in adolescent women and to estimate incidences of gestational adverse events and complications of antenatal consulting compared to young adults in an outpatient environment in Germany using the IMS Disease Analyzer database.

Understanding pregnancy complications in adolescents in outpatient care contributes to the health-care professionals' ability to provide effective care for this demographic.

2. MATERIAL AND METHODS

2.1. DATABASE

The IMS Disease Analyzer database (IMS Health) compiles drug prescriptions, diagnoses and basic medical and demographic data obtained directly and in anonymous format from computer systems used in the practices of a representative panel of gynaecological practitioners (Becher et al. 2009).

Diagnoses (ICD-10), prescriptions (Anatomical Therapeutic Chemical (ATC) Classification System) and the quality of reported data have been monitored by IMS based on a number of criteria (e.g. completeness of documentation, linkage between diagnoses and prescriptions). The validity and representativeness of the Disease Analyzer database have been previously demonstrated (Becher et al. 2009). In past years, Disease Analyzer data was used and published in several epidemiological studies in the field of gynaecology (Ziller et al. 2013, Jacob et al. 2015).

2.2. STUDY POPULATION

Between January 2004 and December 2013, pregnancy (ICD-10: Z32.1, Z33) was confirmed and/or pregnancy supervision (ICD-10: Z34, Z35) was initiated for the first time in 14,720 women aged 14 to 24 years in the German gynaecological practices identified in the IMS Health database.

The following categories were excluded: women devoid of information regarding pregnancy outcome within 330 days after the index date and women with a documentation of multiple gestation (ICD-10: O30) as it engenders additional risks. Women with medical (O04) or failed attempted (O07) abortion and its complications (O08) were also excluded as this study examines the natural course of pregnancy.

2.3. STUDY OUTCOME

The primary outcome measure was the impact of age on the most common pregnancy-induced diseases, pregnancy-associated disorders and complications prior to birth. The choice of study variables was based on previous literature and clinical relevance. All study variables are listed with International Classification of Diseases-10 codes. The frequencies of the following conditions were estimated:

pregnancy with abortive outcome (O00–03,05 and 06); oedema, proteinuria, hypertensive disorders and pre-existing hypertension (O10–16); urinary tract infection (UTI) (N30, N34, N39, O23.1,2 and 3); (pyelo-)nephritis (PN) (N10, N12, O23); chlamydia trachomatis infection (CT) (A56, A74); gestational diabetes mellitus (GDM) (O24.4, O24.9); pre-existing type 1 diabetes mellitus (O24.0–O24.3); excessive weight gain (O26.0); low weight gain (O26.1); poor foetal growth (O36.5); haemorrhage in early pregnancy (O20); cervical insufficiency (O34.3); mental disorders and diseases of the nervous system (O99.3); mal-presentation of foetus (O32); premature rupture of membranes (PROM) (O42); antepartum haemorrhage (O46); and preterm labour (O60) (Appendix 7.3).

2.4. STATISTICAL ANALYSIS

To estimate the impact of age, pregnant teenagers (under 19 years old) were compared to a control group of women aged 20 to 24 years old. Previous studies examining teenage pregnancies have heterogenic cut offs in comparing teenage pregnancies. In this study the teenage group was further divided into two groups: the under-aged teenagers (<18 years) and 18- and 19-year-old teenagers. This further differentiation was chosen as girls usually reach full physical development by ages 15 to 17 (Marcell 2007) thus potentially presenting additional risk factors due to these developmental changes. Furthermore, the official German birth and abortion statistics are based on this age division as well as relevant previous studies about teenage pregnancies in Germany (Thoss et al. 2006). This age division will therefore facilitate comparison between studies and offer a basis for further research.

For each group the frequencies of the selected conditions were estimated. Logistic regressions were used to determine the influence of age group with regard to pregnancy-induced diseases and pregnancy-associated disorders. Logistic regression models were used to adjust for the number of gynaecological visits during the observation period and co-diagnosis of obesity (ICD-10: E66). Diagnosis of obesity was used due to lack of body mass index (BMI) information.

The analyses were carried out using SAS version 9.3. The analysis followed established national (Swart et al. 2009) and international good practice recommendations for secondary data analysis (Motheral et al. 2003).

3. RESULTS

3.1. STUDY POPULATION

The database included 314 doctors in 262 gynaecological practices who continuously reported to IMS Health during the study period on 2,006,100 patients:

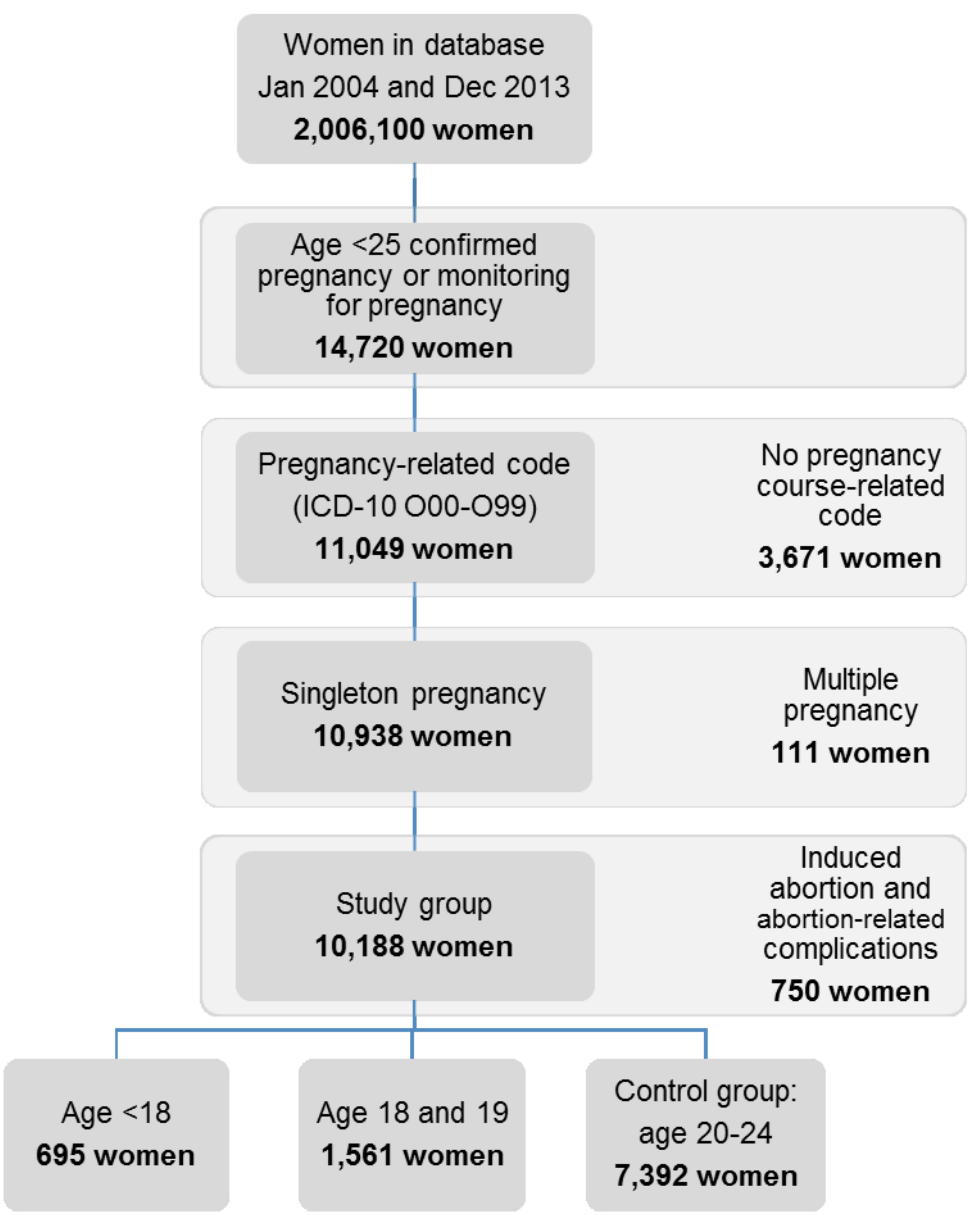


Figure 1 showing the selection of the study population

Over the 10-year analysis period, 14,720 pregnancies were analysed and inclusion criteria applied to 10,188 pregnancies.

The age distribution of the study group reflects the age distribution of pregnant teenagers in the general population presenting an increasing number of pregnancies with increasing age: more than 80% of the teenagers of the young adolescent group are 16 and 17 years old. The mean age for each group was 16.3 years, 18.6 years and 22.3 years, respectively (Table 1 in Appendix).

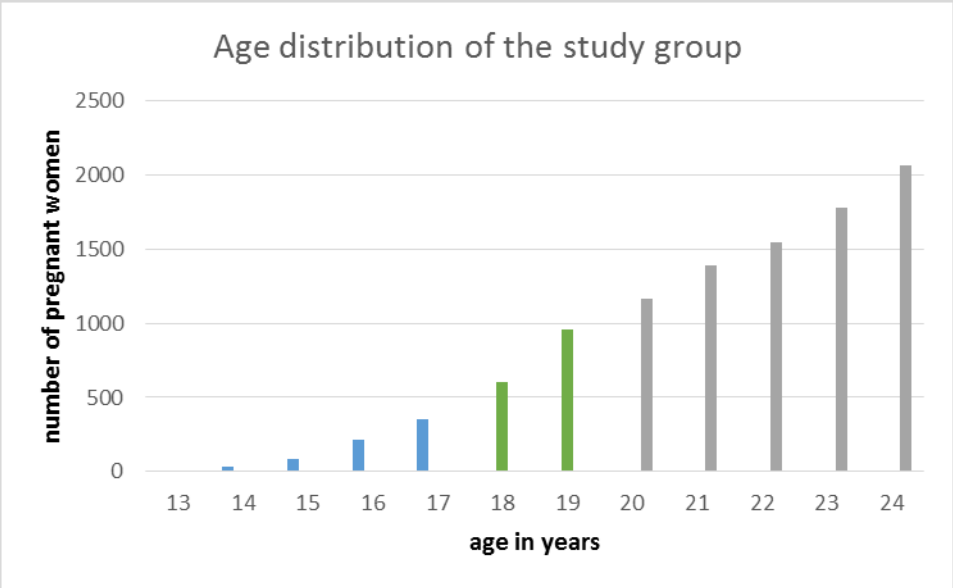


Diagram 2: The diagram shows the age distribution within each age group

The number of antenatal visits was significantly lower for women aged below 18 years (8.2 vs. 8.8 vs. 9.8). The groups did not differ with regard to obesity (Table 2 in Appendix).

3.2. STUDY OUTCOME

The number of adverse events, their odds ratio (OR), confidence interval (CI) and p-value (p) are shown in Appendix 7.3.

3.2.1. PREGNANCIES WITH ABORTIVE OUTCOMES

Both groups exhibited a significantly elevated risk of spontaneous abortions (OR 1.66, CI 1.35–2.03, p<0.001 and OR 1.20, CI 1.02–1.41, p=0.029). They had lower

incidences of extra-uterine pregnancies, hydatidiform moles and other abnormal products of conception. This difference was only significant for the youngest teenage group (OR 0.58, CI 0.39–0.88, p=0.009 and OR 0.8, CI 0.63–1.03, p=0.088) (Appendix 7.3.1).

3.2.2. MATERNAL DISORDERS AND CARE RELATED TO PREGNANCY, THE FOETUS AND POSSIBLE DELIVERY PROBLEMS

The under 18 group was significantly less affected by gestational hypertension (OR 0.57, CI 0.39-0.85, p=0.005) but no statistically significant difference was shown in the older teenage group (OR 0.86, CI 0.69-1.08, p=0.202). No significant differences were reported for proteinuria and oedema (OR 0.63, CI 0.43–0.94, p=0.024 and OR 0.84, CI 0.66–1.07, p=0.153) or pre-eclampsia (OR 0.47, CI 0.23–0.95, p=0.036 and OR 0.74, CI 0.50–1.09, p=0.123). The number of patients with pre-existing and chronic hypertension (OR 2.58, CI 0.30–21.86, p=0.386 and OR 2.00, CI 0.40–10.03, p=0.40) and eclampsia (OR 0.11, CI 0.17–6.38, p=0.867 and OR 0.36, CI 0.05–2.71, p=0.32) was insufficient to allow any reliable conclusions. Both teenage groups had a significantly higher rate of UTIs (OR 1.37, CI 1.09–1.74, p=0.008 and OR 1.31, CI 1.11–1.54 p=0.001). No significant differences were reported for pyelonephritis (OR 1.04, CI 0.41–2.60, p=0.942 and OR 1.00, CI 0.52–1.91, p=0.998) or CT infections (OR 1.44, CI 0.64–3.38, p<0.402 and OR 1.13, CI 0.59–2.18, p<0.708). For both adolescent groups, significantly lower complication rates were recorded for GDM (OR 0.38, CI 0.20–0.71, p=0.003 and OR 0.67, CI 0.48–0.93, p=0.016). Excessive weight gain was similar in all age groups (OR 0.61, CI 0.19–1.95, p=0.401 and OR 1.22, CI 0.68–2.19, p=0.401) but the 18- to 20-year-old mothers had a significantly higher incidence of low weight gain (OR 3.63, CI 1.64–8.06, p=0.002). The number of the under-17-year-old girls was insufficient to allow any reliable conclusions (OR 0.82, CI 0.11-6.23, p=0.848). No significant differences were recorded for poor foetal growth (OR 0.79 (0.56–1.12) p=0.183 and OR 0.95 (0.76–1.19) p=0.660). Both teenage groups were less frequently reported with haemorrhage in early pregnancy (OR 0.67, CI 0.52–0.87, p=0.003 and OR 0.84, CI 0.72–0.99, p=0.042) but this was only significant for the under 18 years old. Similar rates among all groups were observed for cervical insufficiency (OR 0.96, CI 0.66–1.39, p=0.815 and OR 1.04, CI 0.81–1.33, p=0.767). The youngest group exhibited a greater number of mental disorders

and diseases of the nervous system (OR 1.34, CI 1.04–1.74, p=0.025 and OR 1.06, CI 0.87–1.28, p=0.574) (Appendix 7.3.2).

3.2.3. COMPLICATIONS OF LABOUR AND DELIVERY

No statistical difference was noted for the incidence of premature rupture of membranes (OR 0.54, CI 0.22–1.34, p=0.185 and OR 1.10, CI 0.70–1.73, p=0.683) and disproportion between foetus and pelvic bones (OR 0.66, 0.27–1.63, p=0.364 and OR 0.53, CI 0.28–1.03, p=0.059). The incidences of antepartum haemorrhage (OR 0.44, CI 0.22–0.90, p=0.024 and OR 1.02, CI 0.73–1.42, p=0.921) and preterm labour (OR 0.69, CI 0.54–0.87, p=0.002 and OR 0.95, CI 0.82–1.10, p=0.524) were significantly lower for the younger teenage group and showed no statistically significant difference in the older teenage group (Appendix 7.3.3).

4. DISCUSSION

The aim of this study was to analyse pregnancy outcomes in teenage pregnancies. Two age groups (under 17 years and 18 to 19 year olds) were compared separately to the control group of the 20- to 24-year-old pregnant women.

Previous studies were predominantly conducted on a retrospective basis, using hospital records or birth registrations, thus excluding abortive outcomes. Studies concerning teenage pregnancies can differ widely with regards to setting, patient pool and data collection. Furthermore, differences in health insurance systems and antenatal care guidelines can greatly affect study outcomes.

Our objective was to estimate the risk of adverse events according to maternal age as a proportion of all pregnancies intended to be carried to term – that is, live births, stillbirths, spontaneous abortions and ectopic pregnancies. The representative coverage offered by the IMS Disease Analyzer database allows a realistic view of adverse events in the course of pregnancy as observed in an outpatient environment. This observational study analysed adverse events in an outpatient environment in Germany, a country with a low teenage delivery rate, comprehensive high-quality antenatal care and low rates of maternal and perinatal mortality (European Perinatal Health Report 2010).

4.1. AGE DISTRIBUTION

The age distribution of the teenagers (Diagram 2, page 23 and Appendix 7.3) was in accordance to the age distribution of mothers giving birth in Germany registered by the Federal Statistical Office and in the Profamilia study conducted in 2006 (Thoss et al. 2006) thus indicating a representative sample of pregnant adolescents in this study. The Profamilia study gives a useful complementary insight to the social-cultural background of adolescents that could not be provided by the IMS-Disease Analyzer.

4.2. ANTENATAL CARE

Women under 20 years of age attended significantly fewer antenatal care visits (8.2 vs. 8.9 vs. 9.8 visits during the observational period). This is in accordance with earlier studies, where adolescents had significantly lower rates of antenatal class

attendance and antenatal visits in the first trimester and sought antenatal care later than adults (Fleming et al. 2013 and 2015, Quinlivan & Evans 2004, Leppälahti et al 2013, Gupta et al 2008, Thoss et al. 2006). Due to normally irregular menstrual cycles and not keeping track of them, an adolescent may not be concerned about a late period and thus take more time before confirmation of pregnancy. For some young women this may be because they are not expecting to become pregnant or are in denial of the possibility of pregnancy after a missed period. Others may fear disapproval or fear that they will be pressed to an abortion when they want a baby (Emans et al. 2012, Thoss et al. 2006, Gupta et al. 2008). Others might be more reluctant to seek antenatal care and will attend antenatal care less frequently once the pregnancy has been confirmed. Often teenagers lack knowledge about corporal changes during pregnancy but also during adolescence and might therefore be less aware of pathological changes that should normally lead to a medical visit. They are also less informed about the resulting benefits of antenatal care for their unborn child and themselves (Kingston et al. 2012, Thoss et al. 2006).

In some countries, financial reasons might lead to a decrease in attendance rates of antenatal care, although this ought not to be a deterrent in Germany since antenatal care is free of charge.

A higher rate of antenatal visits of the control group may possibly be explained by a higher rate of pregnancy-related adverse events leading to increased consultations.

Proper antenatal care with tailored services to the teens' medical and psychosocial needs has been widely discussed as one of the protective factors of adverse antenatal events (Quinlivan & Evans 2004). Counselling about nutrition, substance abuse, tobacco, domestic violence and depression are all important elements of care. Inadequate antenatal care, in combination with young age, is strongly associated with other important maternal, obstetrical and neonatal adverse outcomes among adolescents (Fleming et al. 2013, Debiec et al. 2010).

The main finding of this study is that despite fewer antenatal visits, teenagers in this study exhibited improved outcomes once the risk of spontaneous abortion, infections and mental disorders were dismissed, indicating a sufficient benefit from antenatal care (Diagram 4, page 32).

4.3. PREGNANCIES WITH ABORTIVE OUTCOMES

Previous studies on adverse events were predominantly conducted on a retrospective basis, using hospital records or birth registrations, thus excluding abortive outcomes. In this study the risk of abortive outcomes depending on the maternal age was estimated as a proportion of all pregnancies intended to be carried to term. Abortive outcomes included spontaneous abortion, ectopic pregnancies and abnormal products of conception.

Both groups exhibited a significantly elevated risk of spontaneous abortion (OR 1.66, CI 1.35–2.03, p<0.001 and OR 1.20, CI 1.02–1.41, p=0.029) but they had lower incidences of extra-uterine pregnancies, hydatidiform moles and other abnormal products of conception. This difference was only significant for the youngest teenage group (OR 0.58, CI 0.39–0.88, p=0.009 and OR 0.8, CI 0.63–1.03, p=0.088).

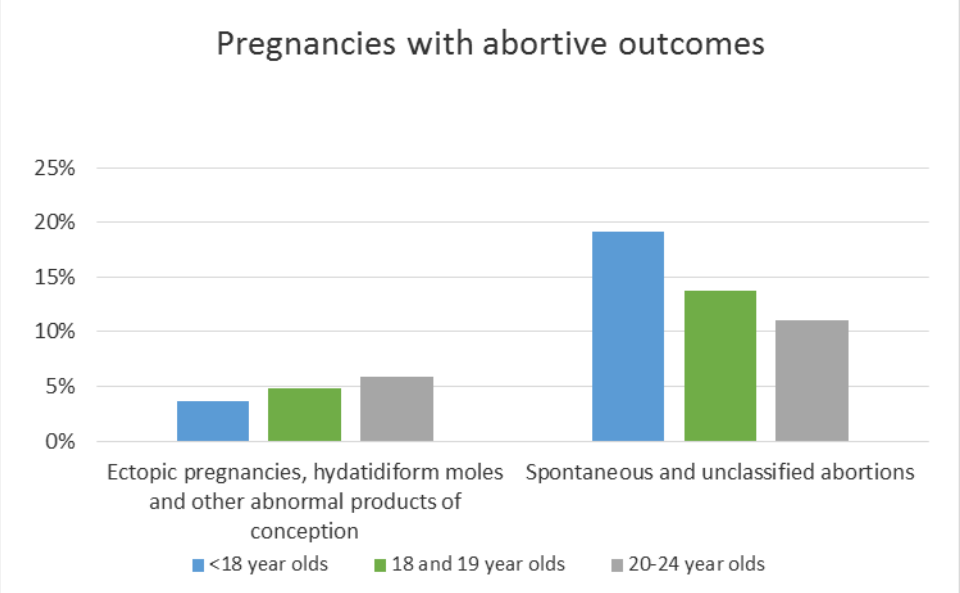


Diagram 3: The diagram shows the prevalence of abortive outcomes for each age group (in %) divided into spontaneous or unclassified abortions and ectopic pregnancies, hydatidiform moles and other abnormal products of conception

4.3.1. SPONTANEOUS ABORTIONS

The highest risk of spontaneous abortions, also referred to as miscarriages, was found for the under 18 year olds at 19.1%. The incidence of 13.7% was substantially lower for the 18 to 19 year olds but remained significantly higher in comparison to the control group.

There are few studies that examine spontaneous abortions in minors and the reported rates show great variability, from 8% to 20% (Buss et al. 2006, Blohm et al. 2008, Nybo Andersen et al. 2000, Creatsas & Elsheikh, 2009). Whereas in some studies the miscarriage rate in adolescents was not increased (Wyatt et al. 2005, Nybo Andersen et al. 2000), the results of the present study are in accordance to others reporting an increased miscarriage rate and are similar to those reported from the USA (National Center for Health Statistics, 2008).

Various factors, such as methods used to confirm a pregnancy, time of enrolment, and the start and ending points of observation, may contribute to the variations. Some studies with low rates for miscarriage were based on investigations in countries with high abortion rates, where pregnancies ultimately resulting in clinical miscarriage were terminated as legal abortions prior to the miscarriage occurring (Blohm et al. 2008).

Most previous studies analysed spontaneous abortions leading to an admission to hospital, thus underestimating the miscarriage rate as not every miscarriage is involves hospitalisation, but can also be diagnosed and treated in the outpatient environment. In this study, data collected includes miscarriages diagnosed directly in an obstetrical practice as well as those diagnosed at hospital and subsequently coded during the control visit. Misclassification of induced abortions should be minimal, since they are legal prior to 12 weeks of gestation, free of charge and a widely accepted practice in Germany. Nevertheless, the real incidence may be higher, as there is a chance that the pregnancy had not yet been detected when the spontaneous abortion occurred (Giakoumelou et al. 2015).

According to studies, causes of miscarriages cannot be identified for certain but the risk of foetal loss decreases with the advance of gestation (Blohm et al. 2008). Controversially discussed factors of miscarriage include the mother's psychological state, primigravida, chromosomal abnormalities of the foetus, infections, uterine abnormalities, cervical insufficiency, extreme high or low pre-pregnancy BMI, drugs and the parents' age (García-Enguídanos et al. 2002, Blohm et al. 2008, De la Rochebrochard and Thonneau 2002, Nybo Andersen et al. 2000, Maconochie et al. 2007).

Chromosomal abnormalities are mainly responsible for spontaneous abortions in older women (Blohm et al. 2008). There is some evidence suggesting that

miscarriage more frequently affects primigravidae, which would put teenagers at a higher risk (Bakken & Skjeldestad, 2006, Buss et al. 2006), but other authors do not agree with this statement (Nybo Andersen et al. 2000, Blohm et al. 2008).

A number of infections have been linked to miscarriage (Allanson et al. 2010, Giakoumelou et al. 2015). Allanson et al. reported that 77% of tissue samples from miscarriages were infected with bacteria, whereas all control samples from medically induced abortions were uninfected. Multiple partners and a higher rate of sexual intercourse, as well as an immaturity of the immune system, predispose teenagers to a higher risk of infection (Giakoumelou et al. 2015).

In the present study teenagers were more frequently affected by infections than the control group. No information on pre-pregnancy BMI was available but there was no significant difference between the groups concerning obesity and no increased risk for cervical insufficiency.

In previous studies adolescents generally tended to indulge in higher-risk behaviour, including smoking, drugs and alcohol, and were less likely to stop smoking (Giakoumelou et al. 2015); factors that could not be further analysed with the Disease Analyzer database.

It is most likely that co-occurrence of multiple factors explains the higher rate of spontaneous abortion; higher-risk behaviour and a lower immune status being of the most influence. This cannot be further evaluated within the scope of the Disease Analyzer database and more research in this area is required.

4.3.2. Ectopic pregnancies, hydatidiform moles and other abnormal products of conception

Occurrences of ectopic pregnancies, hydatidiform moles and other abnormal products of conception were less frequent than in the control group, a difference which was only statistically significant for the group under 18 years of age.

Ectopic pregnancies are associated with congenital anomalies, infertility, current IUD use, multiple partners, prior ectopic pregnancy and long-term complications from chlamydia infections, smoking, endometriosis, and pelvic or abdominal surgeries (Oppelt and Gätje, 2013, Li et al. 2015, Farquhar 2005, Menon et al. 2015, Kucera-Sliutz et al. 2011). Most of these factors are more common in older women and

explain the increased risk of ectopic pregnancies also cited in other studies (Nybo Andersen et al. 2000, Kucera-Sliutz et al. 2011, Menon et al. 2015).

The incidence of ectopic pregnancies was found to be higher for all age groups than in previous studies. One explanation could be that previous studies are exclusively based on hospital records. As unruptured ectopic pregnancy may be treated with expectant management or medical management, healthy patients who are able and willing to undergo close surveillance may be managed as outpatients and are not necessarily included in hospital statistics. In this study, data collected includes ectopic pregnancies diagnosed directly in an obstetrical practice as well as those diagnosed at hospital and subsequently coded during the control visit.

It has been observed that the prevalence of ectopic pregnancies has been in a continuous augmentation over the last several years probably due to an increase in risk factors such as chlamydia infections (Kucera-Sliutz et al. 2011, Nama & Manyonda 2009). Therefore, education regarding risk factors and screening and treatment of chlamydia in the young, sexually active population, is important to achieve a reduction in the rate of ectopic pregnancies.

In the present study the incidence of abnormal products of conception was similar to those of other European countries with around 1:1,000 pregnancies. However, the sample size, especially of the younger teenage group, was not large enough and a generalisation in the comparison to the other age groups wouldn't be meaningful.

Pregnancies ending in spontaneous abortion do not appear in German official statistics. Official conception rates calculated by adding live births, stillbirths and induced abortions are therefore underestimated, especially in teenagers younger than 18 years old. To our knowledge this is the first study on a nationwide scale that examines age-specific foetal loss rates in Germany, thus offering new data for research in this area.

4.4. MATERNAL DISORDERS AND CARE PREDOMINANTLY RELATED TO PREGNANCY, THE FOETUS AND POSSIBLE DELIVERY PROBLEMS

In the diagram below the results of the studies show that teenagers had generally improved outcomes in comparison to the young adults in the control group aged 20 to 24:

Les paramètres requis sont manquants ou erronés.

Diagram 4: The diagram shows the prevalence of the different disorders predominantly related to pregnancies for each age group in percentages

4.4.1. OEDEMA, PROTEINURIA AND HYPERTENSIVE DISORDERS

Possible complications during pregnancy include hypertensive disorders: Pregnancy-induced hypertension, also referred to as gestational hypertension, is usually defined as the development of new hypertension measured on two separate occasions, more than six hours apart and diagnosed after twenty weeks of gestation. The type of hypertension can be further defined on the basis of other clinical signs, particularly proteinuria, oedema and abnormalities of coagulation. Although well-controlled hypertension alone is benign, the superimposed pre-eclampsia is associated with significant maternal and/or foetal mortality and morbidity (Walker 2000).

In this study the prevalence of pregnancy-induced oedema, proteinuria and hypertension including pre-eclampsia was lower among teenagers. This was only statistically significant for the younger teenage group. The under 18 group was significantly less affected by proteinuria and oedema (OR 0.63, CI 0.43–0.94, p=0.024 and OR 0.84, CI 0.66–1.07, p=0.153). The number of patients with pre-existing and chronic hypertension (OR 2.58, CI 0.30–21.86, p=0.386 and OR 2.00, CI 0.40–10.03, p=0.40) was insufficient to allow any reliable conclusions.

Whereas the majority of previous studies observed lower or similar rates of gestational hypertension for teenagers the risk of pre-eclampsia is a subject that is controversially discussed (Gilbert et al. 2004, Wing et al. 2014, Kawakita et al. 2016, Gupta et al. 2008, Leppälahti et al. 2013, Jeha et al. 2015, Paranjothy et al. 2009, Fleming et al. 2015).

Improper placentation is chiefly responsible for pre-eclampsia yet its pathogenesis is only partially understood (Al-Jameil et al. 2014). Obesity and excessive gestational weight gain, UTI, chronic hypertension, diabetes mellitus, nulliparity and low socio-economic status are among its risk factors (Walker, 2000, Al-Jameil et al. 2014, Sukalich et al. 2006, Baker & Haeri 2012).

According to the literature, pregnant adolescents are more likely to be nullipara and of low socio-economic status compared to the control group, thus exposing them to a higher risk of pre-eclampsia (Giakoumelou et al. 2015). Moreover, the presence of a UTI in pregnancy, particularly in the third trimester, is strongly associated with pre-eclampsia, supporting the hypothesis that the risk of pre-eclampsia is enhanced by an increased maternal inflammatory burden (Easter et al. 2016).

As protective factors, adolescents in this study were less frequently concerned by diabetes mellitus and there were no significant differences concerning maternal obesity and excessive gestational weight gain (Jolly et al. 2000).

Complications of pre-eclampsia can affect both the mother and the foetus: Acutely, pre-eclampsia can be complicated by eclampsia, HELLP syndrome and stroke as well as liver, kidney and lung damage. It is also associated with increased frequency of caesarean section, preterm delivery, and placental abruption. Foetal complications include foetal growth restriction and potential foetal or perinatal death. An individual with pre-eclampsia is at increased risk for recurrence of pre-eclampsia in subsequent pregnancies (Mustafa et al. 2012).

Blood pressure measurement and urine analysis for protein should be carried out at each antenatal visit to screen for pre-eclampsia. The usual care for adult populations is also applied to pregnant adolescents.

The low prevalence in this study could be multifactorial: A higher prevalence of pre-eclampsia in some studies was found to be true mainly for the very young age groups (under 16 years old) (Jeha 2015, Leppälahti et al. 2013, Kawakita et al. 2016). Pregnancies in this age group are rare in Germany and are only represented by 8% in this study. Furthermore, higher rates of pre-eclampsia have also been linked to low socio-economic status, which might not have the same impact in a developed country such as Germany (Silva et al. 2008). Additionally, some studies reported that teenage pregnancy complications can be prevented with regular antenatal care, thus reducing

maternal and/or foetal mortality and morbidity (Gilbert et al. 2004, Paranjothy et al. 2009).

The number of patients diagnosed with eclampsia (OR 0.11, CI 0.17–6.38, p=0.867 and OR 0.36, CI 0.05–2.71, p=0.32) was insufficient to allow any reliable conclusions. In research studies, teenagers faced increased risks of eclampsia, the risks increasing with descending age for most outcomes and linked to inadequate antenatal care (Leppalähti et al. 2013). Further research needs to be done in this area.

4.4.2. URINARY TRACT INFECTIONS

Both teenage groups showed significantly higher rates of UTIs in line with the majority of previous studies (Nybo Andersen et al. 2000, Leppälahti et al 2013, Lewis et al. 2009).

UTIs remain among the most common medical complications during pregnancy. Pregnancy is a state associated with physiological, structural and functional urinary tract changes which promote ascending infections from the urethra: Biochemical changes in urine, with higher amounts of glucose, amino acids and hormone degradation products, increase urinary pH and therefore the risk of infections (Matuszkiewicz- Rowińska et al. 2015). Several studies have confirmed that urinary symptoms occur early in pregnancy and persist throughout the pregnancy (Schnarr & Smaill 2008).

In pregnant women UTIs pose a great therapeutic challenge, since the risk of serious complications in both the mother and child is high. Particularly in the third trimester, the presence of a UTI is strongly associated with pre-eclampsia (Easter et al. 2016). In women with an uncomplicated singleton pregnancy, asymptomatic bacteriuria is not associated with preterm delivery if it does not progress to symptomatic UTI (Matuszkiewicz-Rowińska et al. 2015, Kazemier et al. 2015).

The increased risk of developing a UTI in adolescents is probably a combination of multiple factors: Higher sexual activity and changing partners, poor nutritional status, immaturity of the immune system and a low socio-economic status have been associated with an increased risk of UTIs (Jolly et al. 2000, Nguyen & Weir 2002).

Even though the incidence of UTIs is unchanged whether in pregnancy or outside of pregnancy the screening and treating for UTIs is an important factor in a comprehensive teenage-specific antenatal care programme, as effective antimicrobial therapy represents a potentially low-cost global intervention and has been associated with a decrease of the incidence of pyelonephritis, PTB, and possibly also adverse foetal outcomes like low birth weight (LBW) infants. (Matuszkiewicz-Rowińska et al. 2015, Schnarr & Smaill 2008). Thus, urine testing should be performed during each medical visit and has become a standard of obstetrical care as a part of the German maternal guidelines.

4.4.3. PYELONEPHRITIS

The incidence of pyelonephritis in the teenage groups was very similar to that in the control group. Findings from other studies in similar welfare systems are controversial.

It is usually a consequence of an undiagnosed or inappropriately treated lower UTI. The much higher risk (up to 40%) of progression from UTI to acute pyelonephritis due to physiological structural and functional urinary tract changes is an important complication of pregnancy, and a major cause of perinatal morbidity (Krane & Hamrahian 2007). Acute pyelonephritis is most common in late pregnancy, with 80% to 90% of cases occurring in the second and third trimester.

Several risk factors are associated with acute pyelonephritis in pregnant women: Whereas older mothers would be at an increased risk of pre-gestational diabetes, nephrolithiasis and history of pyelonephritis, teenagers are more likely to be nulliparous and of lower socio-economic status with late diagnosis of UTIs resulting from insufficient follow-up. Furthermore, a poorer recognition of symptoms and therefore delayed treatment could also increase the risk (Leppälahti et al. 2013, Wing et al. 2014).

According to studies, complications of pyelonephritis include anaemia, bacteraemia, septic shock, transient renal dysfunction, pulmonary insufficiency, pre-eclampsia and abortions (Matuszkiewicz-Rowińska et al. 2015, Krane & Hamrahian 2007). Pyelonephritis seems to be an important independent risk factor for preterm deliveries. The exact risk of preterm labour and delivery directly attributable to pyelonephritis in pregnancy is difficult to estimate, particularly because delivery may

not occur during admission for the acute disease, and the risk factors for pyelonephritis, preterm delivery and low neonatal birth weight overlap. Debate exists in the research as to whether treated pyelonephritis is associated with adverse foetal outcomes (Schnarr & Smaill 2008, Matuszkiewicz-Rowińska et al. 2015, Wing et al. 2014).

The low incidence of pyelonephritis indicates proper detection and treatment of UTIs, mainly due to rigorous application of maternal guidelines preventing ascending infection.

4.4.4. CHLAMYDIA TRACHOMATIS INFECTION

CT is not reportable in Germany. Good coverage of chlamydia testing would be expected due to the fact that the test has been free since 2008 and is included in the maternal guidelines. This study showed a higher risk of infection with CT in adolescents, even though there was no statistical difference. The prevalence in this study is comparable to results from other German studies (Haar et al. 2013, Gille et al. 2005, Desai et al. 2011, Robert Koch Institut 2013).

Even though CT is the most common infection among all STIs in Germany (Robert Koch Institut 2010), Gille et al. reported in a study from 2005 that during an educational campaign in 92 schools in Berlin two-fifths of the young people had never heard of CT infections and 94% did not know about the high prevalence of infections among young people. When used correctly and consistently, condoms are effective in reducing the spread of STIs but the unprotected intercourse that led to initial pregnancy is also the major risk factor for STIs.

Teen mothers tend to remain sexually active and are less likely to use condoms during intercourse while pregnant, thus exposing them to a constant risk of infections throughout the pregnancy (Giakoumelou et al. 2015).

The physiologic immaturity of their cervix and the cervical changes occurring in pregnancy seem to favour infections in adolescents (Gille et al. 2005). Infections with CT are associated with chorioamnionitis, spontaneous abortion, pre-eclampsia, premature rupture of membranes, preterm delivery, low birth weight and ectopic pregnancies and postpartum infections.

Vertical transmission of chlamydia during vaginal delivery ranges from 30% to 50% and may result in pneumonia and ophthalmia neonatorum (Fleming et al. 2015, Rours et al. 2011, Raatikainen et al. 2005, Bakken & Skjeldestad 2006, Hill et al. 2005, Peipert 2003).

In this study, higher rates of pre-eclampsia and premature rupture of membranes were not observed. However, the young teenagers were exposed to an increased risk of spontaneous abortion and the control group was prone to an increase in ectopic pregnancies, indicating long-term complications of previous chlamydial infection.

These adverse events are potentially avoidable and further efforts through education, prevention, screening and treatment of chlamydia infections need to be made in the entire population.

4.4.5. GESTATIONAL DIABETES MELLITUS

The rates of GDM were significantly lower in both teenage groups, which confirmed findings from previous studies (Jolly et al. 2000, Al-Jameil et al. 2014, Leppälahti et al. 2013, Conde-Agudelo et al. 2005, Khine et al. 1999, Fleming et al. 2015). The rate of GDM in the control group is similar to those reported by Kleinwechter et al.

Gestational diabetes is caused by improper insulin responses and typically gestational diabetes will disappear after the baby is born.

Risk factors include being overweight, previously having gestational diabetes, a family history of type 2 diabetes and having polycystic ovarian syndrome. The incidence of GDM increases with maternal age (Lao 2006). It is associated with an increased risk of several maternal and foetal adverse events, including urinary tract and vaginal infections, gingivitis, pre-eclampsia, induction of labour, PTB and the risks of late intrauterine death, caesarean sections, shoulder dystocias, perineal tears and postpartum bleeding requiring a blood transfusion. Maternal hyperglycaemia may lead to increased foetal macrosomia, polyglobulia and reduced foetal pulmonary surfactant factor. Postnatal problems include hypoglycaemia and breathing disorders (Kleinwechter et al. 2014). The frequency of poor pregnancy outcomes can be reduced by timely diagnosis and appropriate treatment.

GDM generally has few symptoms and it is most commonly diagnosed by screening by blood tests during pregnancy. Pregnant adolescents follow the same guidelines

and management for GDM as adult women. Sukalich and Khine found that GDM is significantly more common in overweight adolescents. For those at normal risk, screening is recommended between 24 and 28 weeks' gestation. For those at high risk, testing may occur at the first antenatal visit.

4.4.6. MATERNAL WEIGHT GAIN AND POOR FOETAL GROWTH

The groups did not differ with regard to obesity, excessive weight gain (OR 0.61, CI 0.19–1.95, p=0.401 and OR 1.22, 0.68–2.19, p=0.401) or in suspected poor foetal growth (OR 0.79 (0.56–1.12) p=0.183 and OR 0.95 (0.76–1.19) p=0.660), but the 18- to 20-year-old mothers had a significantly higher incidence of low weight gain (OR 3.63, CI 1.64-8.06, p=0,002). The number of the under-17-year-old girls was insufficient to allow any reliable conclusions (OR 0.82, CI 0.11–6.23, p=0,848).

In previous studies, adolescent pregnancy has been associated with poor maternal weight gain (Klein et al. 2005). Concerns about body image and weight changes may cause teens to resist weight gain and other nutrition-related recommendations made during antenatal care visits (Drake 1996).

Poor weight gain has been a controversially discussed risk factor of poorer pregnancy outcomes. Foeto–maternal competition for nutrients, biological and psycho-socioeconomic factors are common explanations for the higher risk of LBW infants, PTB, small for gestational age (SGA) or risk of infant mortality in adolescent mothers (Ganchimeg et al. 2014, Shrim et al. 2011, Leppälahti et al. 2013, Conde-Agudelo et al. 2005, Chen et al. 2008, Marsoosi et al. 2004). Care for the pregnant adolescent should therefore incorporate nutritional care to both optimise weight gain and manage potential nutritional deficiencies (Fleming et al. 2015).

In this study the weight of the newborn is not known but there was no significant difference in the numbers of suspected poor foetal growth in the screening between the three groups. Quinlivan and Evans suggested that the majority of low birth weight deliveries were attributable to PTB rather than intrauterine growth retardation.

Whether or not poorer weight gain influences the foetal outcome cannot be elucidated with the IMS Database and further research is needed in order to prevent negative outcomes for mothers and the foetus. It is important to address nutritional requirements and maternal weight gain when caring for pregnant adolescents to optimise weight gain in pregnancy.

4.4.7. HAEMORRHAGE IN EARLY PREGNANCY

Early pregnancy bleeding refers to obstetrical haemorrhage before 20 completed weeks of gestational age and is a common occurrence. About one-half of those who bleed will miscarry (Deutchman et al. 2009). In this study, in order to estimate the number of patients concerned by haemorrhage in early pregnancy not leading to a termination of their pregnancy all patients with abortive outcomes were excluded. Both teenage groups were less frequently reported as experiencing bleeding in early pregnancy (OR 0.66, CI 0.49–0.89, p=0.007 and OR 0.91 CI 0.76–1.09, p=0.288) but this was only significant for the under 18 year olds.

Possible causes of pregnancy bleeding during the first trimester not leading to abortion include physiological implantation bleeding and other causes by reasons unrelated to pregnancy, such as benign polyps, infections, inflammations or other changes in the cervix. Maternal characteristics associated with bleeding include fibroids and prior miscarriage (Hasan et al. 2010). Subchorionic haemorrhage, or subchorionic haematoma, is the most common sonographic abnormality in the presence of a living embryo (Paspulati et al. 2004). Most subchorionic bleeds resolve on their own, and women go on to have perfectly healthy pregnancies.

When coding for haemorrhage in early pregnancy the cause is not always known or coded. Therefore only assumptions on the study's finding can be made.

The prevalence in the teenage group could be underdiagnosed. As teenagers tend to confirm their pregnancies at a later stage they might simply not consult for bleeding and won't be worried as the pregnancy will often continue normally. This would especially be the case with physiological implantation bleeding as it can occur at the time when the regular menses would have taken place.

On the other hand, causes that are unrelated to the pregnancies might be more frequent with increasing age, such as polyps or inflammation.

Further research needs to be done in this area.

4.4.8. CERVICAL INSUFFICIENCY

Cervical incompetence is variably defined. However, a common definition is a cervical length of less than 25mm at or before 24 weeks of gestation.

The mechanisms underlying premature cervical change in pregnancy are poorly understood but a short cervix is a consistent predictor of an increased risk of preterm delivery, regardless of other factors and the risk has been found to be inversely proportional to cervical length (Myers et al. 2015, Iams 2014).

In this study no significant differences were observed for cervical insufficiency (OR 0.96, CI 0.66–1.39, p=0.815 and OR 1.04, CI 0.81–1.33, p=0.767) and several studies comparing the cervical length in adults and adolescents have reported similar findings (Palma-Dias et al. 2004, Buck et al. 2015).

4.4.9. MENTAL DISORDERS AND DISEASES

In this study the youngest age group exhibited a significantly greater number of mental disorders and diseases of the nervous system than the two other groups. This is in accordance with previous studies (Mollborn & Morningstar 2009).

Adolescents in general are more prone to certain mental disorders and diseases. During pregnancy mental distress is higher in teenagers when compared to adult pregnant women and non-pregnant adolescents (Mollborn & Morningstar 2009, Drake 1996). It remains unclear whether the stressors and experiences of early childbearing lead to mental health problems or whether the mental health outcomes among adolescent mothers are a result of the adverse life circumstances that often precede and predict teen pregnancy (Hodgkinson et al. 2014).

Adolescent immaturity often results in risk-taking behaviours (Hodgkinson et al. 2014), expressed by a higher rate of smoking and substance use which is potentially linked to serious consequences, especially during pregnancy (Fleming et al. 2013, Kawakita et al. 2016).

Achievement of developmental tasks becomes more complicated when the adolescent becomes pregnant as the pregnancy may inhibit the growth of individual identity and personality and interfere with the completion of developmental tasks (Drake 1996, Hodgkinson et al. 2010, Hodgkinson et al. 2014, Paranjothy et al. 2009, Mercer 2004). Corporal changes due to pregnancy and adolescence, as well as the awareness about the effects of their behaviour on foetal development, potentially provokes anxiety and stress (Drake 1996).

Furthermore, pregnant adolescents are often confronted with lower education levels and family income. These socio-economic factors have been reported to enhance stress-related disorders (Fleming et al. 2013, Hodgkinson et al. 2014, Thoss et al. 2006). Mollborn and Morningstar found that teenage mothers' distress levels were already higher than that of their peers before they became pregnant, and they remained higher after childbearing and into early and middle adulthood. Moreover, rates of physical abuse were significantly higher in adolescents (Kingston et al. 2012). Among teenage girls from more affluent families, the relationship between distress and subsequent teenage childbearing was spurious (Mollborn & Morningstar 2009, Hodgkinson et al. 2014, Paranjothy et al. 2009).

As seen in this study, the 18- and 19-year-old adolescents did not show significantly more mental disorders and diseases, which can be explained by their increased somatic and mental maturity as well as an increased social-economic status.

The effects of mental health disorders on pregnancy outcomes remain under-examined. While an association has been found between psychosocial pathology and PTB, it is unclear whether this is due to coexisting confounders or whether there is a true causal relationship (Quinlivan & Evans 2004).

To appropriately meet the needs of pregnant adolescents, routine and repeated evaluation of the cognitive and psychosocial development and treatment of mood disorders is recommended (Fleming et al. 2015).

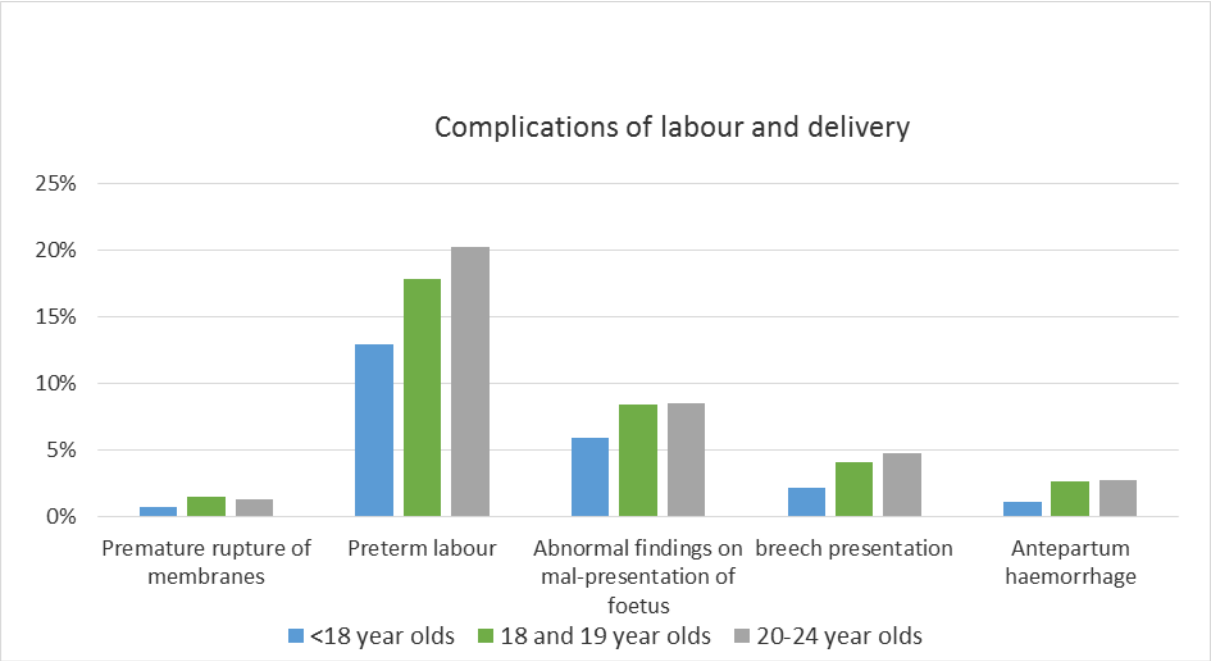
Mental disorders and diseases of the nervous system are more likely to be underdiagnosed by gynaecological practitioners and might not be as accurate as they would have been if coded in a psychiatric practice, thus probably leading to an underestimation of these adverse events.

The gathered information is still very useful as it strengthens the conviction of the need of an interdisciplinary cooperation when taking care of adolescent pregnancies. Because maternal distress can compromise the outcomes of both mother and child regardless of its cause, distress in teenage mothers should be taken seriously and addressed (Mollborn & Morningstar 2009). Klein reported that the majority can have positive outcomes similar to those of their peers who bear children later, particularly when they are provided with strong social and functional supports. Enabling the teenage mother to raise a child in an environment free of violence, with adequate

support, stable housing and adequate treatment of any coexisting psychiatric illness is essential to prevent problems of child abuse and neglect (Quinlivan & Evans 2004).

4.5. COMPLICATIONS OF LABOUR AND DELIVERY

Although the database content does not allow a focus on pregnancy duration or delivery outcome, the trend given by these numbers is interesting.



The prevalence of premature membrane rupture was significantly less frequent in the youngest teenage group and highest in the group of 18 to 19 year olds. Findings in literature on this topic remain controversial: Whereas Fleming et al. reported a significantly increased risk of spontaneous rupture of membranes in adolescents, Conde-Agudelo found progressively increasing rates with increasing maternal age.

Preterm labour with or without delivery was coded less frequently for the younger teenage group. This is in contrast to most previous studies, even though recent studies based on hospital records from countries with adequate antenatal care corroborate these findings (Schönfeld 2011, Fleming et al. 2013). In this study the number of pregnant women diagnosed with preterm labour might be underestimated, as women might directly visit a hospital and the adverse event would therefore not be coded at a gynaecologic practitioner's office.

By comparison, significantly fewer incidences of abnormal findings on mal-presentation of the foetus, including breech presentation, before onset of labour were diagnosed for the teenage groups. The low number of breech presentations in teenagers confirmed by previous studies is one of the explanations of the high rates of normal vaginal delivery and lower proportions of caesarean or instrumental deliveries reported in teenage pregnancies (Shrim et al. 2011).

Similarly, the rates of antepartum haemorrhage increased with increasing maternal age and late pregnancy decreased with decreasing age. This is in accordance with previous literature (Conde-Agudelo et al. 2005).

However, women presenting with complications related to labour and delivery are more likely to be seen directly at a hospital. This might lead to an underreporting of these adverse events in this study as the IMS Disease Analyzer database retrieves data exclusively from an outpatient environment. As this should be true for all groups the results remain comparable and can indicate a trend. Other studies have reported similar outcomes, especially when adequate antenatal care was available (Quinlivan & Evans 2004, Raatikainen et al. 2006).

4.6. LIMITATIONS

It must be acknowledged that certain limitations exist in this study.

It was retrospective in design and relied on ICD-10 codation to establish diagnoses. Thus, limitations are linked directly to the ICD-10 codations and include missing data due to coding omissions which may have reduced the statistical significance of our results.

Furthermore, only pregnancies were examined where at least one adverse event was reported. Therefore, pregnancies without any complications, even though unlikely, are not included in this study.

Teenage pregnancies may be underrepresented due to denial of the pregnancy or reluctance to seek medical advice.

Variables such as nutritional status, whether pregnancies were intended or not intended, socio-economic status and race/ethnicity could not be included since this information is not available in the database. This may have residual confounding effects. Future studies on German adolescent pregnancies that control for these variables are needed.

Comparison with previous studies is difficult as the majority of studies are done on a retrospective basis from hospital records or birth registrations, thus excluding abortive outcomes. Depending on the trimester, the occurrence of the adverse event per pregnant woman would be different. Furthermore, variable results between studies may also be due to differing age definitions for adolescents (e.g. 18 years vs. 20 years) and age distributions. In this study, 82% of the adolescents younger than 18 years old were aged 16 and 17.

5. CONCLUSION

Studies examining pregnancies in adolescents followed in an outpatient environment are rare. This study is unique as most studies on this topic are based on retrospective pregnancy course analyses from hospital records whereas this database gets its data directly from the obstetric offices. The strength of this study lies in its patient pool's size and national coverage giving a complete and realistic reflection of the situation regarding obstetric challenges among teenage pregnancies. To our knowledge, this is the largest clinically oriented study to date documenting pregnancy outcomes in German adolescents.

It confirms that adolescents can have positive outcomes equal to those who bear children later. Hence our positive results may at least partly stem from the high quality of the maternity care system in Germany: free of charge, used by almost the entire pregnant population, consisting of numerous antenatal visits and using advanced technology. Nevertheless, additional efforts ought to be made to ensure higher antenatal care attendance.

Moreover, a high prevalence of psychological difficulties among younger teenagers demands high-quality multidisciplinary collaboration addressing their needs, to ensure healthy pregnancies and to reduce adverse perinatal outcomes. This is especially important as their environment might not be able to provide the assistance they need.

As infections play a major role in teenagers, detection should be carried out on a repetitive basis throughout the course of the pregnancy, as they are potentially modifiable risk factors.

For future research the age-specific foetal loss rates reported in this study can be of benefit.

6. LITERATURE

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7. APPENDIX

7.1. TABLE 1: AGE DISTRIBUTION

Age	Number of patients
13	4
14	30
15	89
16	216
17	356
18	603
19	958
20	1,161
21	1,387
22	1,542
23	1,781
24	2,061

7.2. TABLE 2: BASELINE CHARACTERISTICS

	<18	18-19	20-24	p-value
Patient pool	695	1,561	7,932	
Age (Mean, SD)	16.3 (0.9)	18.6 (0.5)	22.3 (1.4)	<0.0001
Number of antenatal visits (Mean, SD)	8.2 (5,8)	8.8 (6.1)	9.7 (6.5)	<0.0001
Obesity (ICD-10: E66)	6.3%	7.6%	7.8%	0.3633

7.3. TABLE 3: RATES OF MATERNAL COMPLICATIONS

Rates of maternal complications during pregnancy according to age group, their respective percentages and adjusted OR (95% CI) for the association between maternal age and maternal complications in pregnancy.

7.3.1. PREGNANCIES WITH ABORTIVE OUTCOMES

Maternal age in years (number)	<18 (695)	18–19 (1561)	Reference group 20–24 (7932)
Spontaneous abortions	133	214	875
	19.1%	13.7%	11.0%
	1.66 (1.35–2.03) p<0.001	1.20 (1.02–1.41) p=0.029	1
EP, hydatidiform moles, other abnormal products of conception	25	75	467
	3.6%	4.8%	5.9%
	0.58 (0.39–0.88) p=0.009	0.80 (0.63–1.03) p=0.088	1

7.3.2. MATERNAL DISORDERS AND CARE PREDOMINANTLY RELATED TO PREGNANCY, THE FOETUS AND POSSIBLE DELIVERY PROBLEMS

Maternal age in years (number)	<18 (695)	18–19 (1,561)	Reference group 20–24 (7,932)
Pre-existing and chronic hypertension	1	2	6
	0.1%	0.1%	0.1%
	2.58 (0.30-21.86) p=0.386	2.00 (0.40-10.03) p=0.400	1

Gestational oedema and proteinuria	27	85	569
	3.9%	5.4%	7.2%
	0.63 (0.43-0.94) p=0.024	0.84 (0.66-1.07) p=0.153	1
Gestational hypertension	2	24	113
	0.3%	1.5%	1.4%
	0.57 (0.39–0.85) p=0.005	0.86 (0.69-1.08) p=0.202	1
Pre-eclampsia	8	30	227
	1.2%	1.9%	2.9%
	0.47 (0.23–0.95) p=0.036	0.74 (0.50–1.09) p=0.123	1
Eclampsia	1	1	16
	0.1%	0.1%	0.2%
	0.84 (0.11–6.39) p=0.867	0.36 (0.05–2.71) p=0.320	1
UTIs	94	209	904
	13.5%	13.4%	11.4%
	1.37 (1.09–1.74) p=0.008	1.31 (1.11–1.54) p=0.001	1

Pyelonephritis	5	11	61
	0.7%	0.7%	0.8%
	1.04 (0.41–2.60) p=0.942	1.00 (0.52–1.91) p=0.998	1
Chlamydia trachomatis	42	100	336
	6.0%	6.4%	4.2%
	1.04 (0.41–2.6) p=0.281	1.50 (0.90–2.52) p=0.121	1
Gestational diabetes mellitus	10	42	349
	1.4%	2.7%	4.4%
	0.38 (0.20–0.71) p=0.003	0.67 (0.48–0.93) p=0.016	1
Excessive weight gain	3	14	65
	0.4%	0.9%	0.8%
	0.61 (0.19–1.95) p=0.401	1.22 (0.68–2.19) p=0.401	1
Low weight gain	1	10	16
	0.1%	0.6%	0.2%
	0.82 (0.11-6.23) p=0.848	3.63 (1.64-8.06) p=0.002	1

Poor foetal growth	36	101	580
	5.2%	6.5%	7.3%
	0.79 (0.56-1.12) p=0.183	0.95 (0.76-1.19) p=0.660	1
Haemorrhage in early pregnancy	68	198	1237
	9,8%	12,7%	15,6%
	0.67 (0.52-0.87) p=0.003	0.84 (0.72-0.99) p=0.042	1
Cervical insufficiency	32	79	430
	4.6%	5.1%	5.4%
	0.96 (0.66–1.39) p=0.815	1.04 (0.81–1.33) p=0.767	1
Mental disorders and diseases	73	141	718
	10.5%	9.0%	9.1%
	1.34 (1.04–1.74) p=0.025	1.06 (0.87–1.28) p=0.574	1

7.3.3. COMPLICATIONS OF LABOUR AND DELIVERY

Maternal age in years (number)	<18 (695)	18–19 (1561)	Reference group 20–24 (7932)
Premature rupture of membranes	5	23	107
	0.7%	1.5%	1.3%
	0.54 (0.22–1.34) p=0.185	1.10 (0.70–1.73) p=0.683	1
Preterm labour	90	279	1608
	12.9%	17.9%	20.3%
	0.69 (0.54–0.87) p=0.002	0.95 (0.82–1.10) p=0.524	1
Abnormal findings on mal-presentation of foetus	41	132	676
	5.9%	8.5%	8.5%
	0.70 (0.50-0.97) p=0.032	1.04 (0.85-1.26) p=0.734	1
Antepartum haemorrhage	8	42	221
	1.2%	2.7%	2.8%
	0.44 (0.22-0.90) p=0.024	1.02 (0.73-1.42) p=0.921	1

8. ABBREVIATIONS

ATC	Anatomical Therapeutic Chemical
BMI	Body Mass Index
CI	Confidence Interval
CT	Chlamydia Trachomatis
EU	European Union
GDM	Gestational Diabetes Mellitus
HELLP	Haemolysis, Elevated Liver enzymes and Low Platelet count.
ICD-10	International Statistical Classification of Diseases, 10th Revision
IMS	Intercontinental Marketing Services
LBW	Low Birth Weight
OR	Odds Ratio
p	p-value (p)
PN	Pyelonephritis
PROM	Premature Rupture Of Membranes
PTB	Preterm Birth
SAS	Statistical Analysis System
SD	Standard Deviation
SGA	Small for Gestational Age
STI	Sexually Transmitted Infection
UK	United Kingdom of Great Britain and Northern Ireland
UNICEF	United Nations International Children's Emergency Fund
UTI	Urinary Tract Infection
WHO	World Health Organization

9. ABSTRACT

9.1. ABSTRACT IN ENGLISH

STUDY OBJECTIVE

Pregnancies in children and adolescents remain a challenging situation. To analyse the pregnancy course of teenagers in an outpatient environment in Germany we investigated the course of adolescent pregnancies including obstetric adverse events and complications of antenatal consulting and compared them to young adults using the IMS-Disease-Analyzer.

DESIGN, SETTING AND PARTICIPANTS, MAIN OUTCOME MEASURES

A retrospective analysis of singleton pregnancies in women younger than 24 years old between January 2004 and December 2013 was performed to compare maternal pregnancy adverse outcomes of adolescents below 18 years and 18 to 19 year olds to young adults 20 to 24 years old.

RESULTS

Of the 10,188 pregnancies reviewed, 695 (7%) were adolescents younger than 18 years old and 1,561 (15%) aged 18 and 19 years. The youngest group were at highest risk of mental disorders (1.34, 1.04–1.74, p=0.025). Both teenage groups showed a significantly elevated risk of spontaneous abortions (1.66, 1.35–2.03, p<0.001 and 1.20, 1.02-1.41, p=0.029) and UTIs (1.37, 1.09–1.74, p=0.008 and 1.31, 1.11–1.54, p=0.001). Otherwise they didn't present significantly more obstetric adverse events than adults.

CONCLUSIONS

On the basis of the findings, it confirms that adolescents can have positive outcomes equal to those who bear children later indicating an adequate maternity care in Germany. They present less obstetric and antenatal adverse events, apart from mental disorders, spontaneous abortions and UTIs.

These results improve our understanding of the obstetric and medical issues associated with teenage pregnancy and can further improve appropriate approaches

to care. Still more research needs to be done to better understand and to reduce the high rates of abortions and infections. Furthermore, additional efforts ought to be made to ensure higher antenatal care attendance.

KEYWORDS

teenage pregnancy, adolescent pregnancy, maternal age, IMS, adverse events, miscarriage, preterm birth, maternal morbidity, foetal loss, outpatient

9.2. ABSTRACT IN GERMAN (ZUSAMMENFASSUNG AUF DEUTSCH)

STUDIENZIEL

Schwangerschaften bei Kindern und Jugendlichen bleiben eine herausfordernde gesellschaftliche und gesundheitliche Aufgabe, die sowohl die Schwangeren als auch deren Kinder betreffen. Um Schwangerschaften bei Jugendlichen in einem ambulanten Umfeld in Deutschland zu untersuchen, analysierten wir in der gynäkologischen Praxis kodierten Schwangerschaftskomplikationen einschließlich der geburtshilflichen Nebenwirkungen bei Jugendlichen und verglichen diese mit denjenigen junger Erwachsener mit Hilfe des IMS-Disease-Analyzer.

STUDIENDESIGN, METHODEN UND TEILNEHMER, ERGEBNISSE

Über einen Zeitraum von zehn Jahren (Januar 2004 bis Dezember 2013) wurde eine retrospektive Analyse von schwangerschaftsbezogenen Diagnosen bei Einling-Schwangerschaften durchgeführt. Dabei wurden die Ergebnisse von Jugendlichen unter 18 Jahren und 18-19 Jahre mit denen junger Erwachsener zwischen 20-24 Jahren verglichen.

ERGEBNISSE

Von den 10 188 Schwangerschaften waren 695 (7%) Jugendliche jünger als 18 Jahre alt und 1 561 (15%) zwischen 18 und 19 Jahren alt. Die jüngste Gruppe hatte das höchsten Risiko für psychische und Verhaltensstörungen (OR 1.34, CI 1.04-1.74, p = 0.025). Beide Jugendgruppen zeigten ein signifikant erhöhtes Risiko für spontane Abtreibungen (OR 1.66, 1.35-2.03, p <0.001 und 1.20, 1.02-1.41, p = 0.029) und UTI (OR 1.37, CI 1.09-1.74, p = 0.008 und OR 1.31, CI 1.11-1.54, p = 0.001). Ansonsten wurden bei Teenagern nicht deutlich mehr geburtshilfliche Nebenwirkungen als bei jungen Erwachsenen registriert.

SCHLUSSFOLGERUNGEN

Die vorliegenden Ergebnisse bestätigen, dass Jugendliche nicht mehr pränatale Komplikationen als ältere Schwangere aufzeigen, was unter anderem auf eine ausreichende Mutterschaftspflege in Deutschland hindeutet. Nur im Bereich der spontanen Abtreibungen, Harnwegsinfekte, psychischen und neuronalen Krankheiten sind Jugendliche einem höheren Risiko ausgesetzt. Die Ergebnisse

dieser Studie erweitern unser geburtshilfliches und medizinisches Verständnis im Zusammenhang mit Teenager-Schwangerschaften und können dazu beitragen, deren Versorgung weiter zu verbessern. Weitere Forschungsarbeiten sind nötig, um die hohe Rate von Aborten und Infektionen zu verstehen und reduzieren.

SCHLÜSSELWÖRTER

Teenager-Schwangerschaft, IMS, Nebenwirkungen, jugendliche Schwangerschaft, Fehlgeburt, Frühgeburt, mütterliche Morbidität, mütterliches Alter, fötaler Verlust, ambulant

10. VERZEICHNIS DER AKADEMISCHEN LEHRER

Meine akademischen Lehrer an der Philipps University in Marburg waren:

Albert, Arnold, Aumüller, Barth, Basler, Baum, Beato, Bien, Bock, Born, Briel, Christiansen, Daut, Duda, Engel, Engenardt-Cabilic, Feuser, Fruhstorfer, Geus, Goerke, Görg, Gotzen, Gressner, Griss, Habermehl, Hadji, Happle, Hesse, Kälble, Kalder, Kann, Kern, Kienapfel, Klenk, Klose, Koolman, Kretschmer, Krieg, Kroll, Kühnert, Lange, Lennartz, Lorentz, Maisch, Moll, Moosdorf, Müller, Mutters, Neubauer, Oertel, Pfab, Printz, Remschmidt, Richter, Rothmund, Schachtschabel, Schäfer, Schmidt, Schnabel, Schüffel, Schulz, Schwarz, Seifart, Slenska, Steiniger, Stinner, Vohland, Wagner, Werner, Wichert von, Zwiorek

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